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BUREAU OF PLANT INDUSTRY—BULLETIN No. 9.

B. T. GALLOWAY, Chief of Bureau.

THE NORTH AMERICAN SPECIES OF SPARTINA.

BY

ELMER D. MERRILL, Assistant Agrostologist,
GRASS AND FORAGE PLANT INVESTIGATIONS.

Issued February 4, 1902.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1902.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., November 25, 1901.

Sir: I have the honor to transmit herewith the manuscript of a paper entitled The North American Species of Spartina and to recommend that it be published as Bulletin No. 9 of the Bureau series. The paper was prepared by Mr. Elmer D. Merrill, Assistant Agrostologist, Grass and Forage Plant Investigations, and was submitted by the Agrostologist.

Respectfully,

B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

Withdrawn
FEB 7 '40

PREFACE.

The accompanying technical paper on the genus *Spartina* is based entirely on material from North America, and the recent great increase in the available amount of herbarium material has shown the pressing need for a thorough inquiry into the bibliography, synonymy, and relationships of the several species which comprise the genus.

The various species of *Spartina* are found in saline soils along the coast throughout the tropical and temperate regions of the world, two species are found in alkaline soils of the interior, and one species only is known to thrive in soils free from alkaline or saline properties.

At different times various authors have proposed at least 6 different generic names for the grasses now comprised in *Spartina*, and under the name *Spartina* alone about 36 specific names have been proposed for the dozen or fifteen valid species now known in the world. Of these species, 9 are recognized as growing in North America, and are described in the present paper, one of which and one variety are proposed as new.

F. Lamson-Scribner.
Agrostologist.

Office of the Agrostologist,
Washington, D. C., November 16, 1901.

THE NORTH AMERICAN SPECIES OF SPARTINA.

SPARTINA Schreb. Gen. **1**: 43. 1789. (*Trachynotia* Michx. Fl. Bor. Am. **1**: 63. 1803; *Limnetis* Pers. Syn. **1**: 72. 1805; *Ponceletia* Thou. Fl. Trist. d'Acugn. 36. 1811; *Tristania* Poir. in Lam. Encycl. Suppl. **4**: 526. 1816; *Solenachne* Steud. Syn. Pl. Gram. 12. 1854; *Chauvinia* Steud. l. c. 362.)

Spikelets 1-flowered, strongly flattened laterally, sessile, and closely imbricated in two rows along one side of a continuous rachis, forming unilateral spikes which are scattered along a common axis; rachilla articulated below the empty glumes and not produced beyond the floret. Glumes three, the first two empty, keeled, acute, or bristle pointed, unequal, the second usually exceeding the flowering glume. Stamens 3. Styles elongated, filiform. Grain narrow, free within the glume and palea. Coarse perennials, with strong, creeping rootstocks, rigid culms, and long, tough leaves.

Spartina comprises a small but distinct genus of the tribe *Chlorideae* of almost strictly halophytic grasses ranging along the coasts of Europe, Africa, North and South America, and in saline or alkaline soils of the interior, *Spartina cynosuroides* being somewhat exceptional to this rule, as it reaches its greatest development along streams and lakes of fresh water. There are about 12 recognized species in this genus in the world, 9 of which are found in North America, one of which is here proposed as a new species.

Bentham[a] removed *Spartina* from the *Chlorideæ* and placed it in the *Chamaeraphis* group of the *Paniceae* for the reasons that the spikelets contain but a single perfect flower, and that the pedicels are articulated below the empty glumes. Scribner[b] discusses this transfer with the conclusion that *Spartina* should properly be referred to the *Chlorideae*, as its affinities are with this tribe rather than with the *Paniceae*, with the query that as the articulation of the pedicel below the empty glumes forms an exception in certain genera in the *Poaceae* and other tribes, why should not *Spartina* be considered a like exception in the *Chlorideae*. Hackel retains the genus in the *Chlorideae*.

As a genus *Spartina* does not take high rank from an economic standpoint, but as the several species grow in situations where other or better grasses will not thrive it must be considered as possessing a distinct economic value. Several of the species, on account of their strong, creeping rootstocks, are valuable for binding river banks and sea shores subject to wash. *Spartina cynosuroides* annually supplies many thousands of tons of native hay in the middle West, and it has been utilized for making a coarse paper. *Spartina patens* with "black grass" (*Juncus gerardi*) furnishes the bulk of the "salt hay" of the Atlantic coast, and on account of its tough, wiry culms and leaves it is especially adapted for use as packing material for crockery, glassware, etc.

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[a] Notes on the Gramineae, Journ. Linn. Soc. **19**: 50. 1881.

[b] Bull. Torr. Bot. Club, **10**: 85. 1883.

Among the points of particular interest brought out in the present paper are that *Spartina glabra* Muhl., has been wrongly referred to the European *S. stricta*, a species not found in North America, while on the other hand *Spartina versicolor* Fabre, from southern Europe, is doubtless identical with *Spartina juncea* of our Atlantic coast. *Spartina foliosa* Trin., is a valid species, while *Vilfa spartinae* Trin., is identical with *Spartina junciformis* Engelm. & Gray.

On account of many intergrading forms it has been found rather difficult to properly characterize some species in this genus, but we trust that the present paper may serve to clear up some difficult points, at least in synonymy. This article is based entirely on material in the United States National Herbarium, and examination of other herbaria would doubtless extend the range of some of the species here considered.

ANALYTICAL KEY TO THE SPECIES.

1.	Leaf-blades plane or nearly so	2
1.	Leaf-blades strongly involute	6
2.	Second glume very strongly aculeolate-scabrous on the keel and adjacent nerves.	3
2.	Second glume glabrous, or if aculeolate-scabrous only so on the keel	5
3.	Plants very stout; spikelets 12 to 14 mm. long	4
3.	Plants slender; spikelets 6 to 9 mm. long; a Western species	6 **S. gracilis.**
4.	Spikes very numerous, second glume scarcely awned	2 **S. polystachya.**
4.	Spikes few, second glume bearing a stout scabrous awn	1 **S. cynosuroides.**
5.	Inflorescence dense and spike-like; culm leaves numerous, short; a Pacific coast species	4 **S. foliosa.**
5.	Inflorescence usually somewhat open, the spikes ascending or erect.	3 **S. glabra.**
6.	Spikes appressed, forming a long, dense, spike-like inflorescence.	5 **S. junciformis.**
6.	Spikes erect or spreading; inflorescence not spike-like	7
7.	A stout plant; the leaves sometimes 18 dm. in length	9 **S. bakeri.**
7.	Plants more slender; leaves not exceeding 8 dm. in length	8
8.	Spikes broad; a Western species	6 **S. gracilis.**
8.	Spikes narrow; Atlantic coast species	9
9.	Plant slender, not exceeding 9 dm. in height; leaves spreading, less than 3.5 dm. in length	8 **S. patens.**
9.	Plant stouter, often 12 dm. high or more; leaves erect or ascending, 2 to 6 dm. long	7 **S. juncea.**

1. **SPARTINA CYNOSUROIDES** (Linn.) Willd. Enum. 80. 1809. (*Dactylis cynosuroides* Linn. Sp. Pl. 71. 1753; *Trachynotia cynosuroides* Michx. Fl. Bor. Am. **1**: 64. 1803; *Limnetis cynosuroides* Pers. Syn. **1**: 72. 1805; *Spartina pectinata* Bosc. in Link, Jahrb. **3**: 92. 1820.)

A stout erect perennial 6 to 18 dm. high with unbranched glabrous culms from stout, scaly rootstocks, long tough leaf-blades and 5 to 20 spikes, forming a terminal panicle. Sheaths crowded below; ligule a ring of hairs; leaf-blades 3 to 12 or 18 dm. long, 4 to 14 mm. wide, scabrous on the margins, becoming involute in drying, attenuate into a long slender tip. Spikes 5 to 10 cm. long, often on peduncles, 1 to 2 cm. in length, ascending, racemose along the main axis, which is scabrous on the margins, as are also the secondary axes. Spikelets densely imbricate, 12 to 14 mm. long; empty glumes unequal, strongly aculeolate-scabrous on the rigid keels, the first usually acute, the second long acuminate and more or less awned; flowering glume 7 to 9 mm. long, glabrous, except for the aculeolate-scabrous midnerve which terminates just below the emarginate or 2-toothed apex. Palea thinner in texture and usually somewhat exceeding the glume.

General distribution: In swamps and along banks of streams and lakes of fresh or brackish water, Nova Scotia to Assiniboia and Washington, south to New Jersey and Indian Territory, August to October.

Type locality: "Habitat in Virginia, Canada, Lusitiana."

Specimens examined.—*New Brunswick:* St. John, J. Fowler, Aug. 17, 1877. *Maine:* Cape Elizabeth, F. Lamson-Scribner, July 27, 1895, also July 26, 1895; Chemo Pond, Bradley, 3 F. P. Briggs, August, 1897. *Massachusetts:* Nantucket, E. N. Vasey, Aug. 22, 1897. *Connecticut:* Bridgeport, E. H. Eames, July 27, 1895. *New York:* Niagara Falls, F. V. Coville, Aug. 21, 1886. *New Jersey:* Deal, A. H. and C. E. Smith; Granton, salt marsh, Wm. M. Van Sickle, July 1, 1894, also July 1, 1895. *Pennsylvania:* Easton, Thos. C. Porter, Sept. 5, 1896; Harrisburg, John K. Small, July 26, 1888; mouth of Tucquan, Lancaster County, A. A. Heller and E. Gertrude Halback, Oct. 1, 1892. *Delaware:* Ellendale, Wm. M. Canby; Wilmington, 260 A. Commons, July 28, 1881, also 259 Commons, Aug. 16, 1877. *Maryland:* Great Falls, Vasey, 1873. *District of Columbia:* Washington, in grass garden, Aug. 5, 1897. *Illinois:* Pierceville, L. M. Umbach, Aug. 22, 1895. *Wisconsin:* Near Grandmother Bull Falls, L. S. Cheney, 1893. *Minnesota:* Courtland, C. A. Ballard, July, 1892. *Assiniboia:* Indian Head, John Macoun, Aug. 15, 1895. *North Dakota:* Dickinson, M. A. Brannon, Aug. 11, 1896. *South Dakota:* Near Grindstone, 749 David Griffiths, Aug. 31, 1897; Black Hills, altitude 4,000 feet, 1103 P. A. Rydberg, July 16, 1892; Huron, 3 David Griffiths, Aug. 25, 1896; Orol Butte, 331 D. Griffiths, July 1, 1897; Brookings, T. A. Williams, August, 1891; Aberdeen, 96 David Griffiths, Sept. 12, 1893, also 116 Griffiths, Sept. 15, 1896; Jamesville, 4 L. A. Bruce, Aug. 3, 1899. *Iowa:* Chariton, 1001 S. H. Mallory, Oct. 2, 1897; Fayette County, 320 B. Fink, July 6, 1894, also 559 Fink, September, 1894; Mount Pleasant, J. H. Mills, 1894. *Nebraska:* Whitman, 1577 P. A. Rydberg, July 29, 1893; Talmage, 10 C. C. Elmore, July 7, 1896; Niobrara River, 2892 Fred Clements, Aug. 18, 1893; North Platte, 2514 P. A. Rydberg, Sept. 5, 1895. *Kansas:* Hutchinson, 5 B. B. Smyth, July 28, 1890; Riley County, 562 J. B. Norton, Oct. 5, 1895; Syracuse, 156 C. H. Thompson, July 28, 1893. *Indian Territory:* Choctaw Agency, J. M. Bigelow, 1853; Pawnee, J. W. Blankinship, Aug. 30, 1895. *Montana:* Madison River, 2283 P. A. Rydberg, July 28, 1895, 523 C. L. Shear, July 28, 1895. *Wyoming:* At G. A. Bell's ranch, altitude 1300 m., 2844 T. A. Williams, Aug. 5, 1897; No Wood Creek, 2846 T. A. Williams, Aug. 5, 1897; no locality, Hayden's U. S. Geological Survey, 1870. *Colorado:* La Salle, 764 C. L. Shear, Sept. 4, 1895; Fort Collins, 558 C. S. Crandall, altitude 1520 m., Aug. 24, 1894. *Idaho:* Thompson, 1611 J. B. Leiberg, altitude 620 m., Aug. 27, 1895; Lake Tesemini, 691 J. H. Sandberg, A. A. Heller, and D. T. McDougal, July 21, 1892. *Washington:* Fish Hook Ferry, 938 J. B. Leiberg, altitude 210 m., Sept. 18, 1894; Snake River, Almota, 2372 C. V. Piper, Sept. 9, 1896. *Oregon:* Snake River, Ballard's Landing, 2221 Wm. C. Cusick, July 8, 1899; Cascades of the Columbia, E. Hall, 1871.

This widely distributed species is extremely variable, but is usually readily recognized. In the middle West hundreds of acres of lowland are occupied almost exclusively by this grass, which when cut early makes a fair but coarse hay. It has been successfully employed in the manufacture of twine and coarse paper and makes an excellent and durable thatch. Its strong creeping rootstocks adapt it to binding loose sands and river banks subject to wash.

A small form of this species evidently connects it with *Spartina gracilis* Trin., and is represented by the following specimens:

Specimens examined.—*Wyoming:* Deer Creek, 2715 T. A. Williams, July 28, 1897; Beulah, 415 D. Griffiths, Aug. 5, 1897. *Idaho:* St. Anthony, 46 E. D. Merrill, Aug. 12, 1900.

2. **SPARTINA POLYSTACHYA** (Michx.) Willd. Enum. 81. 1809, in obs. (*Trachynotia polystachya* Michx. Fl. Bor. Am. **1**: 64. 1803; *Limnetis polystachya* Rich. in Pers. Syn. **1**: 72. 1805; *Spartina cynosuroides major* Trin. Agrost. **1**: 92. 1840. *Spartina cynosuroides polystachya* Scribn. Bull. Torr. Bot. Club, **10**: 86. 1883, in obs.; Beal, Grasses N. A. **2**: 398. 1896.)

A stout, erect, glabrous perennial, 12 to 18 dm. high, with long, flat leaves and terminal panicles of 20 to 60 crowded ascending spikes 5 to 12 cm. long. Culms often 2 cm. in diameter below, from stout rootstocks. Sheaths imbricate, crowded at the base; ligule a ciliate fringe about 3 mm. long; leaf-blades very long, the uppermost often 6 dm. in length, 8 to 24 mm. wide, strongly scabrous on the margins and more or less scabrous on the nerves on the upper surface, long-attenuate. Panicles 20 to 40 cm. long, the rachis channeled, scabrous; spikes usually crowded, ascending, the lower ones with a peduncle 1 to 2 cm. long, the upper ones sessile, rachis flattened, strongly scabrous on the margins. Spikelets 10 to 14 mm. long, densely imbricate; empty glumes lanceolate, attenuate to a rigid point, glabrous, except on the strongly aculeolate-scabrous keels, or rarely somewhat scabrous throughout, the second 10 to 14 mm. long, 2 to 3 times as long and much wider than the first; flowering glume 7 to 10 mm. long, ovate-lanceolate, obtuse, of similar texture as the empty glumes and similarly ciliate on the keel, rarely scabrous throughout. Palea exceeding the flowering glume, less firm in texture, somewhat obtuse or truncate.

Specimens examined.—*New Jersey:* Granton, W. M. Van Sickle, Aug. 25, 1895; Hackensack, G. V. Nash, Aug. 25, 1889; no locality, J. Holmes, 1890. *Delaware:* Deakyneville, 261 A. Commons, Oct. 8, 1897. *Virginia:* Suffolk, 444 F. L. J. Boettcher, Sept. 12, 1893; Norfolk, 294 T. H. Kearney, jr., Aug. 5, 1895. *North Carolina:* Wilmington, 266 T. H. Kearney, jr., Aug. 3, 1895; Neuse River, G. McCarthy, July 9, 1884. *Alabama:* Mobile, 22 T. H. Kearney, jr., July 3, 1895. *Florida:* No locality, A. W. Chapman; Jacksonville, 3433, A. H. Curtiss, August, 1883; 5518 Curtiss, Aug. 17, 1895; 5149 Curtiss, Aug. 28, 1894; Apalachicola, 102 T. H. Kearney, jr., July 15, 1895. *Mississippi:* Biloxi, 4543 S. M. Tracy, July 6, 1898; Ocean Springs, J. Skehan, September, 1895.

General distribution: In brackish marshes along the coast from New Jersey to Florida and Mississippi, July to October.

Type locality: "Hab. in inundatis maritimis, a Nova Anglia ad Floridam."

This species is related to *Spartina cynosuroides*, but is distinguished by its usually taller and stouter culms, broader leaves, more numerous spikes, absence of awns to the empty glumes, and in the percurrent midnerve of the entire, not cleft, flowering glume.

Michaux, in the original description of this species, gives its range as from New England to Florida, in which he has been followed by later botanists, the range given in the manuals extending as far north as the coast of Maine. None of the northern material examined is *Spartina polystachya* as here interpreted, but is referable to the closely related *S. cynosuroides.* One reason, perhaps, why these two species have been more or less confused is that *Spartina polystachya* has been interpreted to include forms which are evidently referable to *Spartina cynosuroides* and our restriction of the name to the southern form here considered is apparently the only logical course to follow. *Spartina polystachya* is abundantly distinct from *S. cynosuroides*, and there is no reason why the two species should be confused.

3. **SPARTINA GLABRA** Muhl. Gram. 54. 1817. (*Dactylis maritima* Walt. Fl. Carol. 77. 1788, not Curt. Enum. Brit. Gr. 4. 1785; *Limnetis glabra* Nutt. Gen. **1**: 38. 1818; *Spartina lævigata* Bosc in Link, Jahrb. **3**: 92. 1820; *Spartina lævigata* Willd. in Trin. Agrost. **1**: 91. 1840; *Spartina stricta glabra* A. Gray, Man. Bot., ed. 2, 552. 1856; *Spartina stricta maritima* Scribn. Mem. Torr. Bot. Club, **5**: 45. 1894.)

A glabrous, erect, and often stout salt-marsh grass 6 to 24 dm. high, with long, flat, or involute leaves, few or many erect, usually appressed spikes and glabrous spikelets. Culms simple, sometimes 2 cm. in diameter below; sheaths glabrous, the lower ones crowded and imbricate, distichous; ligule a ciliate ring about

2 mm. long; leaf-blades 5 to 7 dm. long, 1 to 1.5 cm. wide, usually flat but sometimes involute, tapering to a long involute tip, glabrous throughout. Panicles 2 to 4 dm. long, usually strict; rachis glabrous. Spikes 5 to 15 cm. long. Spikelets densely imbricate, 10 to 14 mm. long; empty glumes glabrous, or both sparingly scabrous on the keel, the first 6 to 8 mm. long, the second 10 to 14 mm. in length; flowering glume 8 to 10 mm. long. Palea somewhat exceeding the glume and thinner in texture.

GENERAL DISTRIBUTION: In salt marshes along the coast from Virginia to Florida and Texas, also in California. July to October.

TYPE LOCALITY: "Habitat in maritimis, Delaw. N. Ebor."

SPECIMENS EXAMINED.—*Virginia:* Virginia Beach, 3095 T. A. Williams, Sept. 23, 1900. *Florida:* Jacksonville, 5331 A. H. Curtiss, Aug. 28, 1894; also 5577 Curtiss, Oct. 17, 1895; Cedar Keys, 771 R. Combs, Aug. 1, 1898; Homosassa, 941 Combs, Aug. 10, 1898; Braidentown, 1295 Combs, Sept. 3, 1898; Bay Head, 631 Combs, Aug. 23, 1898; Palmetto, 2437, 2437a G. V. Nash, Aug. 21–23, 1895. *Mississippi:* Biloxi, 3854, 3855 S. M. Tracy, Sept. 16, 1897. *Louisiana:* Bayou Hermitage, 92 A. B. Langlois, Oct. 4, 1883. *Texas:* Corpus Christi, 105 G. C. Nealley, August, 1892. *California:* Salt flats, Chollas Valley, San Diego, 569 C. R. Orcutt, July 31, 1882; Newport, 1402, S. B. & W. F. Parish, October, 1882.

This species has been considered as a variety of the European *Spartina stricta* by recent American botanists, but we consider the earlier authors correct in holding it specifically distinct. *Spartina stricta* (Ait.) Roth, has been credited to North America, but a careful examination of all available European and American material leads us to conclude that this species does not extend to North America. Although the European plant occupies the same habitat as the American plant so referred, it is at once distinguished by its rather densely pilose glumes. In *Spartina glabra* the glumes in the typical form are perfectly glabrous, sometimes scabrous on the keel, but never pilose.

3α. **SPARTINA GLABRA ALTERNIFLORA** (Lois.) (*Spartina stricta alterniflora* A. Gray, Man. Bot., ed. 2, 552. 1856; *Spartina alterniflora* Lois. Fl. Gall. **2**: 719. 1807; *Trachynotia alterniflora* Steud. Nom. ed. 2, **2**: 695. 1840.)

Similar to the species in habit of growth, but differing in its sparingly pilose flowering glumes and few-flowered, slender spikes, the spikelets barely overlapping instead of being densely imbricate.

GENERAL DISTRIBUTION: In salt marshes along the coast. Maine to New Jersey. (Europe.)

TYPE LOCALITY: "Habitat circa Baionam, in pascuis limosis ad ripas aturi."

SPECIMENS EXAMINED.—*Maine:* Portland, H. W. Merrill, 1897; Cape Elizabeth, 819 E. E. Gayle, July, 1895. *Massachusetts:* Salem, J. H. Sears, 1883; Cambridge, L. H. Bailey, 1883. *New Jersey:* Atlantic City, F. Lamson-Scribner, August, 1895.

The form here described is identical with several sheets in the U. S. National Herbarium from the coast of France, labeled *Spartina alterniflora*, which is considered as worthy of specific rank by European botanists. Its close relationship to *Spartina glabra* is at once evident, and it presents an intermediate form between that species and the next variety.

3β. **SPARTINA GLABRA PILOSA** var. nov. (*Spartina stricta* of American authors, not Roth.)

Like the species in habit of growth, but differing in its sparingly pilose flowering glumes, in this respect approaching the European *Spartina stricta*. Empty glumes aculeolate scabrous on the keels.

GENERAL DISTRIBUTION: In similar localities as the species, from Massachusetts to North Carolina.

Specimens examined.—*Rhode Island:* Providence, S. T. Olney. *New Jersey:* Atlantic City, F. Lamson-Scribner, August, 1895 (type), also L. F. Ward, Sept. 7, 1884; Weehawken, W. M. Van Sickle, Aug. 20, 1895. *Maryland:* Ocean City, 264 A. Commons, Sept. 16, 1880. *Delaware:* Deakyne's Landing, 265 Commons, Oct. 8, 1897; Delaware City, 266 Commons, Aug. 20, 1874. *Virginia:* Hampton, G. McCarthy, Aug. 31, 1883; Lynnhaven Bay, 2112 T. H. Kearney, jr., Oct. 3, 1898; Fort Monroe, G. Vasey, 1878. *North Carolina:* Ocracoke Island, 2308 T. H. Kearney, jr., Oct. 13–17, 1898; no locality, G. McCarthy, September, 1888.

This variety is distinguished from the species by its sparingly pilose flowering glumes and strongly aculeolate scabrous keels and from the variety *alterniflora* by its densely imbricate spikelets. This form approaches the European *Spartina stricta*, but is distinguished by its much less pilose glumes.

4. **SPARTINA FOLIOSA** Trin. Agrost. **1**: 92. 1840. (*Spartina leiantha* Benth. Bot. Voy. Sulph. 56. 1844.)

A glabrous perennial with numerous, rather short flat leaves, densely flowered spikes and usually very strongly aculeolate-ciliate keeled empty glumes. Culms simple, about 1 cm. in diameter below. Sheaths crowded and overlapping, especially above; ligule a ciliate ring about 2 mm. long; leaf-blades 2 to 3 dm. long, about 1 cm. wide, glabrous throughout, plane or sometimes involute in drying, tapering into a slender involute tip. Panicle 10 to 15 cm. long, almost cylindrical, the spikes densely flowered, 2 to 5 cm. long, appressed, primary, and secondary axes glabrous. Spikelets imbricate, 12 to 14 mm. long, glabrous throughout or the empty glumes usually very strongly aculeolate-ciliate on the keels, the first narrow, 7–8 mm. long, the second, 12 to 14 mm. in length; flowering glume nearly as long as the second empty glume, slightly shorter than the palea, glabrous throughout or sometimes ciliate on the margins below.

General distribution: In salt marshes along the coast. California, August to September.

Type locality: "California."

Specimens examined.—*California:* San Francisco, 124 Bioletti, September, 1891; Oakland, 18 J. W. Blankinship, Aug. 11, 1891; Alameda, J. Burtt Davy, August, 1896; San Diego, 274 E. Palmer, September, 1888; Reclamation, Alice Eastwood, 1897.

This species was based on a specimen collected in California, but has previously been considered as a synonym of *Spartina stricta*. It is closely related to *Spartina glabra*, but is distinguished by its numerous comparatively short leaves, which are crowded on the upper portion of the culm, dense, almost cylindrical spike-like panicles and (usually) the very prominently aculeolate-ciliate keels of the empty glumes. In the original description Trinius describes the spikelets as being glabrous, and in this respect the specimen collected by Davy, cited above, agrees with his description, most of the spikelets being glabrous, although occasionally some of them are sparingly aculeolate-scabrous on the keels of the empty glumes. In all other respects, however, this specimen agrees with the others cited above, in which one of the most prominent distinguishing characters is the prominently aculeolate-ciliate keels of the empty glumes, and which is evidently the common form of the species.

This species is useful in reclaiming salt marshes, and in several places about San Francisco Bay it has modified the coast line and increased the acreage of many farms. The town of Reclamation received its name from the fact that in that vicinity many acres of land have been reclaimed chiefly by the use of this grass.

5. **SPARTINA JUNCIFORMIS** Engelm. & Gray, Bost. Journ. Nat. Hist. **5**: 238. 1845. (*Vilfa spartinæ* Trin. Agrost. **1**: 60. 1840; *Spartina gracilis* Chapm. Fl. So. U. S. 556. 1860; *Spartina gouini* Fourn. Mex. Pl. 135. 1881; *Spartina densiflora* Beal, Grasses N. Am. **2**: 397. 1896, not Brongn.; *Spartina multiflora* Vasey in Beal l. c. 400, in obs.)

A stout glabrous perennial 6 to 18 dm. high with very long narrow involute leaves and short appressed spikes, which form a spike-like inflorescence 10 to 30 cm. long. Sheaths glabrous, the lower ones mostly shorter than the internodes, the upper ones exceeding them; ligule a ciliate fringe; leaf-blades rigid, those of the sterile shoots 3 to 6 dm. long. Panicle tapering to the apex; spikes 30 to 50, 2 to 5 cm. long, sessile, imbricate. Spikelets 6 to 8 mm. long, densely imbricate; empty glumes ciliate-hispid on the keel, the first linear obtuse or acute, shorter than the second, which is truncate and short-awned or emarginate; flowering glume slightly longer than the first glume, rather thin in texture, and ciliate-scabrous on the keel. Palea slightly exceeding the glume in length.

General distribution: In brackish marshes along the coast from Florida to Texas and Mexico. April to October.

Type locality: "Saline prairies near the coast" (Texas).

Specimens examined.—*Florida:* Key West, Blodgett, also J. H. Simpson, June, 1891; Apalachicola, 119 T. H. Kearney, jr., July 16, 1895; Palma Sola Bay, J. H. Simpson, 1890; Hamosassa, 937 R. Combs, Sept. 10, 1898; Cedar Key, 785 Combs, Sept. 2, 1898; no locality, A. W. Chapman (sub. nom. "*Spartina gracilis* of So. Flor." *Mississippi:* Ocean Springs, 133, 134 S. M. Tracy, Sept. 15, 1889; Biloxi, 3783, 3784 S. M. Tracy, Sept. 19, 1897, also 234 T. H. Kearney, jr., Oct. 5, 1896; Bayou St. Louis, 91 A. B. Langlois, Sept. 13, 1883. *Texas:* Eagle Pass, 83 V. Havard, 1882; Meskit Bay, 66 H. W. Ravenel, Apr. 28, 1869; Galveston, L. F. Ward, Sept. 16, 1877; Hockley, F. W. Thurow; Cotula, 30, 33 E. N. Plank, 1891; no locality, G. C. Nealley, 1889. *Mexico:* Hacienda de Angostura, San Luis Potosi, 3760 C. G. Pringle, July 10, 1891.

This very distinct species is readily recognized by its dense spike-like panicles and very narrow involute leaves. Beal based his description of *Spartina densiflora* on No. 3760 Palmer, cited above, which is identical with the forms referred to *Spartina junciformis* Engelm. & Gray, in the same work. *Spartina densiflora* Brongn., has been questionably referred to *Spartina junciformis* Engelm. & Gray as a synonym, but according to Chilean material, collected and determined by Philippi, it is not at all related to that species. The specimen from Philippi is evidently related to *Spartina glabra*, but is apparently distinct from any North American species. It is doubtless identical with *Spartina ciliata* Kunth. *Spartina gouini* Fourn., was based on No. 72 Gouin, from Vera Cruz, Mexico, and although we have not been able to examine this specimen, Fournier's full description leaves no doubt as to the identity of his species.

Vilfa spartinæ Trin. was based on a specimen from Texas, and is, so far as known, the earliest description of the species, and a strict interpretation of the Rochester Rules would make the name *Spartina spartinæ* (Trin)., certainly a meaningless combination. There is in the U. S. National Herbarium a fragment from Trinius's type which was received from the St. Petersburg Academy of Natural Sciences, which clears up any doubt that might exist as to the identity of that species.

6. **SPARTINA GRACILIS** Trin. Agrost. 1: 88. 1840.

A comparatively slender glabrous perennial 3 to 9 dm. high from creeping, scaly, rootstocks, with flat leaves and 3 to 9 rather short, appressed spikes 2 to 5 cm. long. Culm simple; sheaths, at least the lower ones, exceeding the internodes; ligule a ciliate fringe about 1 mm. long; leaf-blades 1 to 3 dm. long, 2 to 6 mm. wide, plane, or often involute, at least when dry, rigid, scabrous on the margins and upper surface, glabrous beneath, long involute-attenuate. Panicle 10 to 20 cm. long, the common rachis glabrous or nearly so, somewhat undulate; spikes appressed, pale or purplish, the lower ones usually somewhat pedunculate, the upper ones sessile or nearly so. Spikelets 6 to 9 mm. long, densely imbricate;

empty glumes acute, aculeolate-ciliate on the keels and also commonly on the adjacent nerves, the first about one-half as long as the acute second one; flowering glume obtuse, slightly shorter than the second and about equaling the obtuse palea, aculeolate-ciliate on the keel.

General distribution: Meadows, swamps, and river bottoms, especially in alkaline soils. North Dakota to Kansas, west to British Columbia, Nevada, and California. April to October.

Type locality: "Amer. bor. (*Hooker*, s. n. *Sp. cynosuroidis*)."

Specimens examined.—*North Dakota:* Minnewaukon, 64 M. A. Brannon, July 17, 1896. *South Dakota:* Aberdeen, 125 D. Griffiths, July, 1896, 842 Griffiths, 1897; Indian Creek, Williams & Wilcox, Aug. 24, 1891. *Kansas:* Syracuse, 110 C. H. Thompson, July 13, 1893. *Montana:* Choteau, 301 Griffiths & Lange, Aug. 22, 1900; Glendive, L. F. Ward, July 15, 1883; Missoula, 265 Williams & Griffiths, 1898; Dillon, 2080 P. A. Rydberg and 335 C. L. Shear, July 3, 1895; Manhattan, 2204 Rydberg and 446 Shear, July 18, 1895; Townsend, 2152 Rydberg, July 15, 1895; East Gallatin Swamps, 3194 Rydberg, July 24, 1896; Upper Big Horn River, 180 J. W. Blankinship, August, 1890; Hound Creek, 329 F. Lamson-Scribner, July 29, 1883; Billings, 235 Williams & Griffiths, Aug. 31, 1898; Buffalo, 105 Williams & Griffiths, Aug. 4, 1898. *Wyoming:* Granger, 3885 A. Nelson, July 30, 1897; Pine Bluffs, 3630 Nelson, July 6, 1897; Laramie County, 2843 Nelson, August, 1896; Otto, 2867 T. A. Williams, Aug. 7, 1897; Belle Fourche River, 2714 Williams, July 28, 1897; Green River, 2328 Williams, July 8, 1897; Yellowstone Park, 3606 Rydberg & Bessey, Aug. 4, 1897. *Colorado:* Canyon City, 985 C. L. Shear, Aug. 10, 1896; Saguache Creek, 1111 J. Wolfe, 1873. *Idaho:* No locality, 3701 L. F. Henderson, 1895; 523 Hayden's expedition, 1872. *Utah:* Rabbit Valley, 353 L. F. Ward, June 10, 1875; Lake Park, S. M. Tracy, Aug. 9, 1887. *Nevada:* No locality, Wheeler, 1872; Reno, M. E. Jones, June 8, 1897; Ash Meadows, 364 Coville & Funston, March 2, 1891; Soda Springs, 323 W. H. Shockley, June, 1882; Unionville Valley, 1298 S. Watson, October, 1867. *California:* Inyo County, 1002 Coville & Funston, June 20, 1891. *Oregon:* Alvord Lake, 2437 J. B. Leiberg, July 1, 1896; no locality, 627 E. Hall, 1871. *Washington:* Douglas County, 2248 L. F. Henderson, July 11, 1892; Loomiston, 891 A. D. E. Elmer, August, 1897; no locality, 248 Sandberg & Leiberg, 1893. *British Columbia:* Kamlooks, 9 J. Macoun, June 13, 1889; *Alberta*, Benton Trail, J. Macoun, July 17, 1895. 13319 Herb. Geol. Surv. Canad.

This widely distributed species is related to *Spartina cynosuroides*, but is readily distinguished by its much smaller size, shorter and narrower leaves, fewer, shorter spikes, much shorter spikelets, and merely acuminate empty glumes, not awned as in that species. Beal[a] refers a specimen from Mississippi to this species, which is evidently an error, and at the same times cites *Spartina junciformis* Engelm. & Gray as a synonym, while on the succeeding page of the same work *S. junciformis* Engelm. & Gray, is properly considered as a distinct species.

7. **SPARTINA JUNCEA** (Michx.) Willd. Enum. 81. 1809. (*Trachynotia juncea* Michx. Fl. Bor. Am. **1**: 64. 1803; *Limnetis juncea* Rich. in Pers. Syn. **1**: 72. 1805; *Dactylis cynosuroides* Walt. Fl. Carol. 77, 1788, non Linn; *Spartina americana* Roth. in Trin. Agrost. **1**: 87. 1840 as syn.; *Spartina versicolor* Fabre (?) Ann. Sci. Nat. III. **13**: 123. *t. 3.* 1849; *Spartina caespitosa* A. A. Eaton Bull. Torr. Bot. Club, **25**: 338. 1898).

A rather stout, tufted, glabrous perennial 5 to 12 dm. high from a usually stout rootstock with numerous long, involute, erect, or ascending leaves and exserted panicles and 2 to 8 erect or spreading, pale or purplish spikes. Culms usually stouter than in *S. patens*, the lower sheaths overlapping; ligule a fringe of hairs; leaf-blades glabrous, except on the upper surface, involute, erect, or ascending, 1.5

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[a] Grasses N. A. **2**: 399. 1896.

to 6 dm. long, or the upper ones somewhat shorter. Panicle exserted, common rachis glabrous or scabrous on the margins. Spikelets densely imbricate, 7 to 10 mm. long; first glume linear, mucronate, usually strongly scabrous on the keel above, 4 to 5 mm. long; second glume lanceolate, acute or acuminate, 7 to 10 mm. long, strongly scabrous on the keel and adjacent nerves and sometimes slightly scabrous on the broad thin margins; flowering glume 6 to 7 mm. long, ovate, obtuse, slightly emarginate at the apex, glabrous or scabrous on the keel above. Palea slightly exceeding the flowering glume, glabrous or nearly so.

General distribution: In salt meadows and sandy beaches along the coast from New Hampshire to Florida and Texas. May to September.

Type locality: "Hab. in siccis maritimis Carolinae, Georgiae."

Specimens examined.—*New Hampshire:* Seabrook, 505 A. A. Eaton, Aug. 27, 1891, also September, 1896, sub nom. *Spartina caespitosa.* *Massachusetts:* Salisbury, 587 A. A. Eaton, Sept. 7, 1896, sub nom. *Spartina caespitosa;* Cambridge, 30 W. W. Bailey, August, 1871. *New Jersey:* Cape May, 263 A. Commons, Aug. 20, 1872; Atlantic City, F. Lamson-Scribner, Aug. 29, 1895, also L. F. Ward, Sept. 7, 1884. *Delaware:* Deakyne's Landing, 262 A. Commons, June 20, 1866. *Maryland:* Baltimore, Dr. Foreman, 1873. *Virginia:* Lambert Point, 1694 T. H. Kearney, jr., July 16, 1898; Cape Henry, 1815 Kearney, July 26, 1898; Norfolk, 307 Kearney, Aug. 5, 1895; Virginia Beach, 1052 A. A. Heller, July 12, 1893, also 3106 T. A. Williams, Sept. 23, 1900. *North Carolina:* Near Wilmington, 153 F. V. Coville, June 27, 1890; Smiths Island, 3516a Biltmore Herbarium, July 14, 1897. *Alabama:* Mobile, 57 T. H. Kearney, jr., July 8, 1895. *Florida:* Jacksonville, 15, 20 R. Combs, July 18, 1898, also 4948 A. H. Curtiss, July 17, 1894; Palmetto, 2439 G. V. Nash, Aug. 21–23, 1895; St. George Island, 131 T. H. Kearney, jr., July 17, 1895; Miami, A. P. Garber 1877; Avondale, 498 Combs, Aug. 16, 1898; Apalachicola, 103, 118 Kearney, July 15, 1895; Braidentown, 1326a Combs, Sept. 3, 1898; Crystal, 1007 Combs, Sept. 16, 1898; Bay Head, 656 Combs, Aug. 23, 1898. *Louisiana:* Pointe à la Hache, 89 A. B. Langlois, June, 1879. *Mississippi:* Biloxi, 1566 S. M. Tracy, July 27, 1891; Chandeleur Island, 4542 Tracy, June 30, 1898; Ocean Springs, 132 Tracy, Sept. 15, 1889; Border of Wolf River, 90 A. B. Langlois, July, 1880; Ship Island, 1087 C. L. Pollard, July 28, 1896, also S. M. Tracy, May 29, 1898, and July 20, 1894. *Texas:* Corpus Christi, 67 G. C. Nealley, August, 1892, also June, 1893.

We believe *Spartina juncea* to be a valid species, for the extreme form is most distinct from *Spartina patens,* to which it has previously been referred. The most striking differential characters are its greater size, much longer, erect or ascending leaves and stouter rootstocks. The spikelets are usually acute, or at least much less acuminate than in *S. patens,* although little dependence can be placed on spikelet characters in this extremely variable group. Michaux based his species on material from Carolina and Georgia, and from his description evidently had small specimens; there can, however, be no doubt as to what form he had in mind. The typical southern form ranges certainly as far north as New York, and we believe Eaton's *Spartina caespitosa* should properly be referred to *S. juncea,* as we can find no valid characters on which to separate the species, the slight variation from typical *Spartina juncea* being evidently that due entirely to habitat. *Spartina versicolor* Fabre, from southern Europe, is evidently identical with our Atlantic coast form here referred to *Spartina juncea.*

The characters on which we have separated *Spartina juncea* from *S. patens* were drawn entirely from herbarium material, and it is very probable that field observations may yield more and better differential characters than here enumerated, and at the same time prove some characters here given invalid.

8. **SPARTINA PATENS** (Ait.) Muhl. Gram. 55. 1817. (*Dactylis patens* Ait. Hort. Kew. 104. 1789; *Spartina pumila* Roth. Cat. **3**: 10. 1806.)

A rather slender, glabrous, very wiry perennial 3 to 8 dm. high, from long, usually slender rootstocks, with 2 to 6 slender, purplish spikes and widely spreading involute leaves. Sheaths mostly inclosing the culms; ligule a fringe of hairs; leaf-blades spreading, 1 to 3.5 dm. long, involute, glabrous, except on the upper surface. Panicle slightly exserted or often somewhat inclosed in the upper sheath, common axis glabrous, spikes spreading or ascending, 2 to 5 cm. long. Spikelets densely imbricate, the first glume about 4 mm. long, linear, mucronate, nearly glabrous; second glume lanceolate, acuminate, 10 to 12 mm. long, scabrous on the keel and adjacent nerves, glabrous on the broad, thin margins; flowering glume 5 to 6 mm. long, ovate obtuse, thin, glabrous, except on the strongly scabrous keel, slightly emarginate. Palea exceeding the glume, similar in texture, but glabrous throughout, or only sparingly scabrous on the keel above.

General distribution: In salt meadows and sands along the coast, from Newfoundland and Nova Scotia to Maryland and possibly farther South. July to August.

Type locality: "Nat. of North America."

Specimens examined.—*New Brunswick:* St. Andrews, J. Fowler, Aug. 16, 1900. *Maine:* Cape Elizabeth, F. Lamson-Scribner, July 26, 1895; Two Bush Island, Penobscot Bay, F. L. Harvey, Aug. 21, 1896. *Massachusetts:* Newbury, 516 A. A. Eaton, Aug. 29, 1896; no locality, W. P. Conant. *Connecticut:* Bridgeport, E. H. Eames, July 25, 1894, July 19, 1898. *New York:* Wading River, Long Island, E. S. Miller, July 23, 1877. *New Jersey:* Weehauken, W. M. Van Sickle, July 8, 1895. *Maryland:* Bay Ridge, F. Lamson-Scribner, Sept. 3, 1897; also F. H. Knowlton, July 13, 1897.

Dactylis patens Ait., was based on material from North America, the name referring to the spreading leaves. There is little doubt as to northern form here considered, being identical with Aiton's species, and was so considered by Muhlenberg, who believed *Spartina patens* and *Spartina juncea* to be distinct, although later authors considered them to be identical. *Spartina patens* is closely related to *S. juncea*, but is distinguished by its usually much smaller size, shorter, widely spreading leaves, smaller rootstocks, and usually more acuminate spikelets.

9. SPARTINA BAKERI sp. nov.

A rather stout glabrous, tufted perennial, 12 to 16 dm. high, with few rigid erect culms and numerous strongly involute leaves 6 to 18 dm. in length, but some of the culm leaves much shorter. Sheaths very close, the lower ones overlapping; ligule a ciliate fringe; leaf-blades rigid, strongly involute, glabrous beneath, strongly scabrous above and on the margins, 4 mm. wide or less when flattened out. Panicle 12 to 18 cm. long, consisting of 5 to 12 appressed purplish spikes 3 to 6 cm. long, common rachis glabrous or slightly scabrous on the margins, partial rachis flattened and scabrous on the margins. Spikelets densely imbricate; empty glumes acuminate, scabrous on the keels, the first very narrow, about 4 mm. long, the second 8 to 10 mm. long; flowering glume about 6 mm. long, scabrous above and on the keel, glabrous below. Palea equaling the glume in length, similar in shape, but of thinner texture, slightly scabrous on the keel above.

Type specimen collected on the east shore of Lake Ola, Tangarene, Florida, No. 14, C. H. Baker, April 19, 1898.

Specimens examined.—*Florida:* Merritts Island, G. L. Bates, March, 1889; Heath, Bates, April, 1889; Cedar Key, 772 R. Combs, Aug. 1, 1898; Jacksonville, 16 Combs, July 18, 1898.

This species is related to *Spartina juncea*, and its floral characters are very similar to that species. It is distinguished, however, by its vegetative characters, its much greater size and very long leaves, and evidently develops much earlier. The following note is based on field observations of Mr. Baker:

"This form grows on lake margins in large and conspicuous tussocks from a few inches to five feet in diameter. Leaves at first erect, but soon recurved and spreading, very numerous, involute and harsh, the longest six and one-fourth feet in length. Culms comparatively few. This grass between seasons sends up culms which do not develop inflorescence, as far as noted, and although it has been observed frequently and at all seasons I have never before seen it in bloom, and consider it very irregular in this respect; it is abundant locally, and predominates over considerable areas about Lake Munroe. The leaves of this grass are persistent and exhibit great durability under exposure to the weather, and while not as abundant as 'wire-grass,' 'rush-grass,' as this species is known, can still be obtained in considerable quantities, and may prove to be of considerable economic importance."

This species has previously been considered as a form of *Spartina patens* (Ait.) Muhl., but is certainly very distinct from that species and from *Spartina juncea* (Mx.) Willd.

Doubtful species.

SPARTINA SCHREBERI J. F. Gmelin in Linn. Syst. Nat. ed. 13, 2: 123. 1791.

This species is credited to North America in Index Kewensis, but we do not know on what authority, as Gmelin based the species entirely on Schreber's generic description and neither Gmelin nor Schreber cite any locality. The genus was doubtless based on the European *Spartina stricta*, and this being the case *Spartina schreberi* should be considered as a synonym of that species.

INDEX.

Page.

- *Chauvinia* Steud 5
- *Dactylis cynosuroides* Linn 6
    - Walt 12
  - *maritima* Walt 8
  - *patens* Ait 13, 14
- *Limnetis cynosuroides* Pers 6
  - *glabra* Nutt 8
  - *juncea* Rich 12
  - *polystachya* Rich 7
- *Ponceletia* Thou 5
- *Solenachne* Steud 5
- Spartina *americana* Roth 12
  - bakeri Merrill 6, 14
  - *caespitosa* A. A. Eaton 12, 13
  - *ciliata* Kunth 11
  - cynosuroides (Linn.) Willd 5, 6, 8, 12
    - *major* Trin 7
    - *polystachya* Scribn 7
  - *densiflora* Beal 10, 11
  - foliosa Trin 6, 10
  - glabra Muhl 6, 8, 9, 10
    - alterniflora (Lois.) Merrill 9
    - pilosa Merrill 9
  - *gouini* Fourn 10, 11
  - *gracilis* Chapm 10

Page.

- Spartina gracilis Trin 6, 7, 11
  - juncea (Michx.) Willd 6, 12, 13, 14, 15
  - junciformis Engelm. & Gray 6, 10, 11
  - *laevigata* Bosc 8
    - Willd 8
  - *leiantha* Benth 10
  - *multiflora* Vasey 10
  - patens (Ait.) Muhl 5, 6, 13, 15
  - *pectinata* Bosc 6
  - polystachya (Michx.) Willd 6, 7, 8
  - *pumila* Roth 13
  - *schreberi* J. F. Gmelin 15
  - *spartinae* (Trin.) 11
  - *stricta* (Ait.) Roth 6, 9, 10, 15
    - *alterniflora* A. Gray 9, 10
    - *glabra* A. Gray 8
    - *maritima* Scribn 8
  - *versicolor* Fabre 6, 12, 13
- *Tristania* Poir 5
- *Trachynotia alterniflora* Steud 9
  - *cynosuroides* Michx 6
  - *juncea* Michx 12
  - *polystachya* Michx 7
- *Vilfa spartinae* Trin 6, 10, 11

BULLETINS OF THE BUREAU OF PLANT INDUSTRY.

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